

Citation:

Anderson JL, Warren CA, Perez E, Louis RI, Phillips S, Wheeler J, Cole M, Misra R. Gender and ethnic differences in hand hygiene practices among college students. *Am J Infect Control*. 2008;36:361-368.

PubMed ID: [18538703](#)

Study Design:

Cross-sectional, Observational Study

Class:

D - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- The purpose of this observational study was to evaluate hand hygiene practices by gender/ethnicity among college students at a large public university in Texas.
- It was hypothesized that hand hygiene compliance would be improved with the addition of visual prompts and hand sanitizers in the restrooms.

Inclusion Criteria:

- None listed; observational study

Exclusion Criteria:

- None listed; observational study

Description of Study Protocol:**Recruitment**

None; observational study at one large public university; 9 different locations were observed

Design: Cross-sectional, observational study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Comparison settings were:

- soap and water
- soap and water and visual prompts

- soap and water and hand sanitizers
- soap and water, hand sanitizers and visual prompts

Main comparisons were with no visual prompt and visual prompt

Statistical Analysis

- Descriptive measures were used to assess students' hand hygiene, handwashing/sanitizing frequency, preference, adequacy, and hand drying method.
- Chi-squared tests measured association between handwashing behavior and gender/ethnicity.
- Student's t-test and analysis of variance were used to evaluate differences in hand hygiene by gender, race/ethnicity, and handwashing/sanitizing frequency in the presence of a visual prompt.
- Effect size was used to estimate the magnitude of differences between groups.
- The data were analyzed using SPSS version 14.0.
- Handwashing was defined as washing the hands with or without soap.
- Handsanitizing was defined as killing bacteria on the hands using an alcohol-based sanitizing gel.
- Hand hygiene included washing the hands with soap and/or sanitizing the hands with an alcohol-based gel.

Data Collection Summary:

Timing of Measurements

- Observations were performed for a 3 week period in May and June 2006.

Dependent Variables

- Hand hygiene
- Handwashing behavior/adequacy (ie 20 seconds)
- Observations were made from a safe distance for obscure monitoring and clustered into 4 settings.
- An interrater reliability of 0.857 was calculated from the scores of observers who watched hand hygiene practices simultaneously and independently rated the relevant variables according to the instruction sheet.

Independent Variables

- Visual prompt (yes or no): "Wash your hands. It prevents infectious disease."
- Gender
- Ethnicity
- Location

Control Variables

- Hand-drying method was noted to evaluate whether students who washed their hands were reluctant to touch unsanitary dispensers.
- Toilet use was not assessed, because it was impossible to determine whether persons exiting restroom stalls had used the toilet.

Description of Actual Data Sample:

Initial N: 1400 observations

Attrition (final N): Total of 1400 observations by seven graduate students (n = 200/student)

Age: not given

Ethnicity:

- Predominantly Caucasian (78%), with 6% African-American, 6% Hispanic, and 9% Asian students.
- Students whose ethnicity could not be determined by the observers were classified as "other" (2%).

Other relevant demographics:

- 86% of the observations were made in female college students; the remaining 14% were in males; data skewness attributed to observers' gender (6 females and 1 male).

Anthropometrics not applicable

Location: large public university in Texas; various campus restrooms located in academic buildings, the student center, and the student recreation center

Summary of Results:

Key Findings:

- 72.9% of students washed their hands, 58.3% practiced hand hygiene (using either soap or hand sanitizer) and 26.1% washed their hands adequately
- Hand sanitizer use was low when students were given the option, and paper towel was the most common hand-drying method
- A significant association was found between gender and handwashing behavior (chi-square = 29.98, $P < .001$), with more female students washing their hands (76%) compared with their male peers (57%).
- Visual prompts improved handwashing behavior only among students in the "other" ethnic category, but not by gender

Hand Hygiene

- Of the 58.3% of students performing hand hygiene, 85.6% washed with soap and water, 8.44% sanitized their hands with an alcohol-based gel, and 5.87% used both. Thus 50.0% of all students washed with soap and water; 4.9% of all students sanitized with alcohol; 3.4% of all students used both soap and water and sanitizer; 41.6% did not perform any hand hygiene.
- 53.5% of Caucasian students, 77.5% of African-American students; 66.3% of Hispanic students; 47.2% of Asian students and 42.9% of the other students used either soap or sanitizing gel.
- Few students used both hand hygiene agents (3.6% Caucasian, 5% African-American, 2.4% Hispanic, 2.4% Asian).
- African-American students had significantly higher rate of hand hygiene practice compared with the Caucasian, Asian and other students.

- Female students had a higher rate of hand hygiene practice (59%) than the males (32%); only females (4%) used both hand hygiene agents.

Handwashing Behavior

- Of the 72.9% of students who washed their hands before exiting the restroom, 71.9% used soap. Thus, 52.4% of all students washed with soap and water; 20.4% of all students washed without soap; and 27.1% of all students did not wash their hands.
- ANOVA indicated significant ethnic differences in handwashing behavior ($P < .001$). African-American students exhibited the highest handwashing frequency (93.8%), whereas the students in the other category had the lowest handwashing frequency (57.1%). However the magnitude of difference was small ($\eta_p^2 = 0.01$).
- Of those students who washed their hands, 35.8% did so adequately and 88.1% dried their hands. Thus 26.1% of all students washed their hands adequately and 64.3% of all students dried their hands.
- Using a paper towel was the most common hand-drying method (96%), followed by person clothing (2%), hand dryer (1%), and towel (1%; recorded only in the student recreation center).
- The racial/ethnic breakdown of handwashing adequacy is as follows: Caucasian 22.9%; African American 58.8%; Hispanic 37.3%; Asian 26.8%; and other 23.8%.
- African American students performed adequate handwashing significantly more often than their peers ($P < .001$). The magnitude of difference was small ($\eta_p^2 = 0.03$).
- No significant gender difference in handwashing adequacy was noted.

Visual Prompt

- Half of the observations ($n=700$) were made in the presence of a visual prompt.
- No significant improvement in hand hygiene compliance was noted in the male, female, Caucasian, African-American, Hispanic and Asian students; however, significant improvement was seen in students in the "other" ethnic category ($t = 2.67$; $P = .01$). The magnitude of this improvement was moderate ($\eta_p^2 = 0.27$).
- African-American students had significantly higher hand hygiene compliance than Caucasians and Asians, and female students had significantly higher hand hygiene compliance than males.
- No significant improvement in handwashing behavior was noted by gender; however, students in the "other" category demonstrated significantly improved handwashing behavior in the presence of a visual prompt ($t = 2.13$; $P = .04$).

Location

- Hand hygiene frequency was significantly higher in the academic buildings/student center (68%) than in the student recreation center (47%; $t = 8.2$; $P < .001$).
- Male, female, White, African-American, and Asian students exhibited significantly higher hand hygiene frequency in academic buildings than in the student recreation center ($P < .05$).
- Handwashing frequency was significantly higher in academic buildings (81%) than in the student recreation center (65%; $t = 6.836$; $P < .001$).
- Male, female, White, African-American, and Asian students exhibited significantly higher handwashing frequency in academic buildings than in the student recreation center ($P < .05$).
- No differences were noted in the African-American, Hispanic or "other" students.

Author Conclusion:

- Overall, the minority students exhibited better hand hygiene practices than the Caucasian students. Thus hand hygiene programs targeted at college students should be tailored to improve hand hygiene in Caucasian students.
- Handwashing is the most effective way of preventing the spread of infectious diseases, and our findings have implications for the design of effective hand hygiene education programs in college students.

Reviewer Comments:

- *Inclusion/exclusion criteria not described.*
- *In results section on location, the authors start talking about frequency of hand hygiene and handwashing behavior. However, the statistical analyses is not different from the previous sections thus use of the term frequency is probably inappropriate. They evaluated the percentage of the total number of observations.*
- *Limitations as cited by authors:*
 - *Although the observers made efforts to be obscure, their presence may have influenced hand hygiene practices in the students.*
 - *The observers were unable to assess whether students used the toilet when in restroom stalls.*
 - *Six of the 7 observers were females, resulting in skewed gender observations.*
 - *Observations were made during the summer school session and could explain the overrepresentation of African-American, Asian and Hispanic students in the sample compared with the university population as a whole.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

- | | | |
|----|---|------------|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | Yes |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | Yes |

Validity Questions

- | | | |
|----|--|------------|
| 1. | Was the research question clearly stated? | Yes |
|----|--|------------|

1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	???
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	No
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	Were study groups comparable?	???
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	???
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A

4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A

7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	???
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	N/A
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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